Space Weather Technical Forecast

Issued on Tuesday, 03 October 2023 at 13:01 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-flares throughout. Slight chance of isolated G1/Minor Storm interval, mainly day 2 (04 Oct).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with one M-flare occurring, peaking M1.9 at 02/1246 UTC. This was from the area of plage southeast of the small sunspot AR3455 near the northeast limb. There are currently eight sunspot regions on the visible disc. AR3450 remains the most likely flare source, due to its slightly more complicated magnetic structure, however this region is now showing signs of decay with a slow reduction in penumbral area. AR3452 in the northeast, and to a lesser extent nearby AR3451, are also of interest but appear to have stabilised AR3453 has also stabilised after recent growth and remains a simple spot. There other spots on the disc are generally smaller, and either stable or decaying.

There were no Earth-directed CMEs observed, with the CME from the M1.9 flare missing, passing behind (east) of Earth.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by ACE at L1, were indicative of slow wind conditions. Speeds were largely at background and on a slow declining trend, 430-330 km/s. Density was at or below average. The interplanetary magnetic field (IMF), Bt, was weak, below 6nT throughout. The north-south component, Bz, was weak throughout, between +4nT and -5nT. Phi angle was predominately positive (away from the Sun). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electrons were Background to Moderate, peaking 566 pfu at 02/1655 UTC. Associated 24-hour fluence was below Active (1e8 integrated pfu) threshold. The observation at 03/0000 UTC was 1.47e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate with a chance of further isolated M-class flares. The main M-flare risk continues to be from either AR3450 in the south-centre disc or the AR3451/52 complex in the northeast.

Solar Wind / Geomagnetic Activity: There are currently no Earth-directed CMEs expected. Solar winds are at background, with any significant connection to CH54/+ in the northwest now considered unlikely. By the end of day 1 (03 Oct) but more likely day 2 (04 Oct), a connection to the fast wind from the small equatorial coronal hole CH55/+ is expected. Any enhancement is likely to be weak, with winds likely increasing to 450-500km/s, as indicated in MOSWOC enlil. Mainly Quiet geomagnetic activity expected with isolated Unsettled spells. Any fast wind arrival has the potential to bring a spell of Unsettled to Active, with a slight chance of G1 Minor Storm intervals, most likely day 2 (04 Oct).

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Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to remain at Background levels, with no Solar Radiation storms expected. High energy electron flux (greater than 2MeV) observed by GOES16 is expected to vary between Background and Moderate levels, with the potential of more significant drop-outs of electron flux to occur given the onset of any fast winds. A slight recovery to Moderate, perhaps diurnally high levels is then possible by day 3 or 4 (04-05 Oct). Fluence is forecast to be below Active (above 1e8 integrated pfu) levels throughout.

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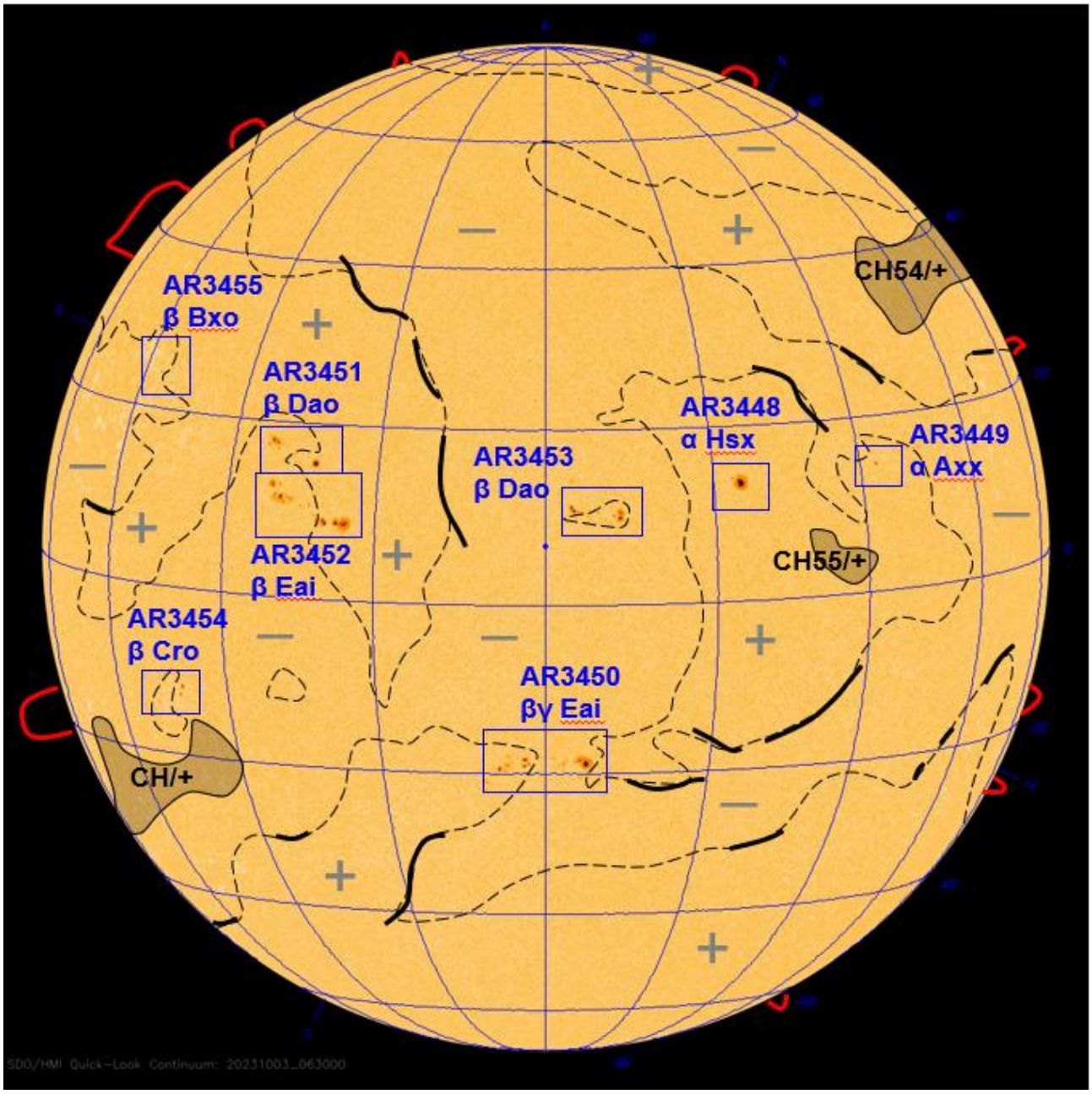
Figure 1. Solar Analysis Valid 03/0700UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are currently no Earth-directed CMEs expected.

Any notable connection to CH54 in the northeast now looks unlikely, but may slightly increase speeds early on day 1 (03 Oct). Later on day 1 (03 Oct) or more likely on day 2 (04 Oct) the arrival of any fast wind associated with equatorial CH55/+ is likely, as indicated in MOSWOC Enlil. This is a small, non-recurrent feature with low confidence for expected speeds, but may increase solar winds to around 450-500km/s, waning into day 3 (05 Oct).
Mainly Quiet geomagnetic activity is expected for much of the period, with isolated Unsettled spells. However, any fast wind arrival has the potential to bring a spell of Unsettled to Active, with a slight chance of G1 Minor Storm intervals, most likely on day 2 (04 Oct).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	20	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected.

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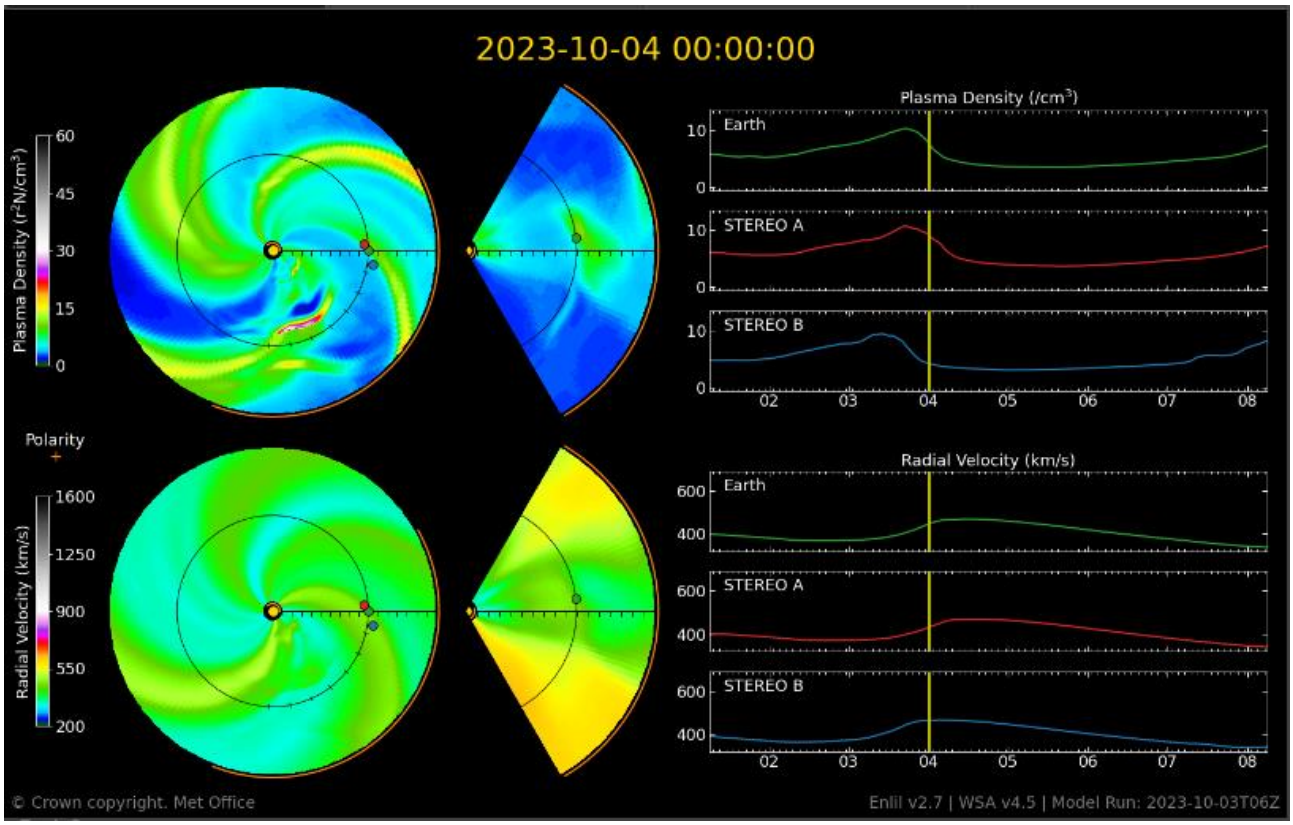
Figure 2: Enlil showing weak enhancement 03 and 04 Oct



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Radio Blackouts - X-Ray Flares:

Low to Moderate activity is expected with a chance of isolated M-class flares.
There are currently eight sunspot regions on the visible disc. AR3450 remains the most likely flare source, due to its slightly more complicated magnetic structure, however this region is now showing signs of decay with a slow reduction in penumbral area. AR3452 in the northeast, and to a lesser extent nearby AR3451, are also of interest but appear to have stabilised AR3453 has also stabilised after recent growth and remains a simple spot. There other spots on the disc are generally smaller, and either stable or decaying.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	50	50	45	40
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is expected to persist at background levels, with the current sunspots on the disc unlikely to produce proton rich flares.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	2	2	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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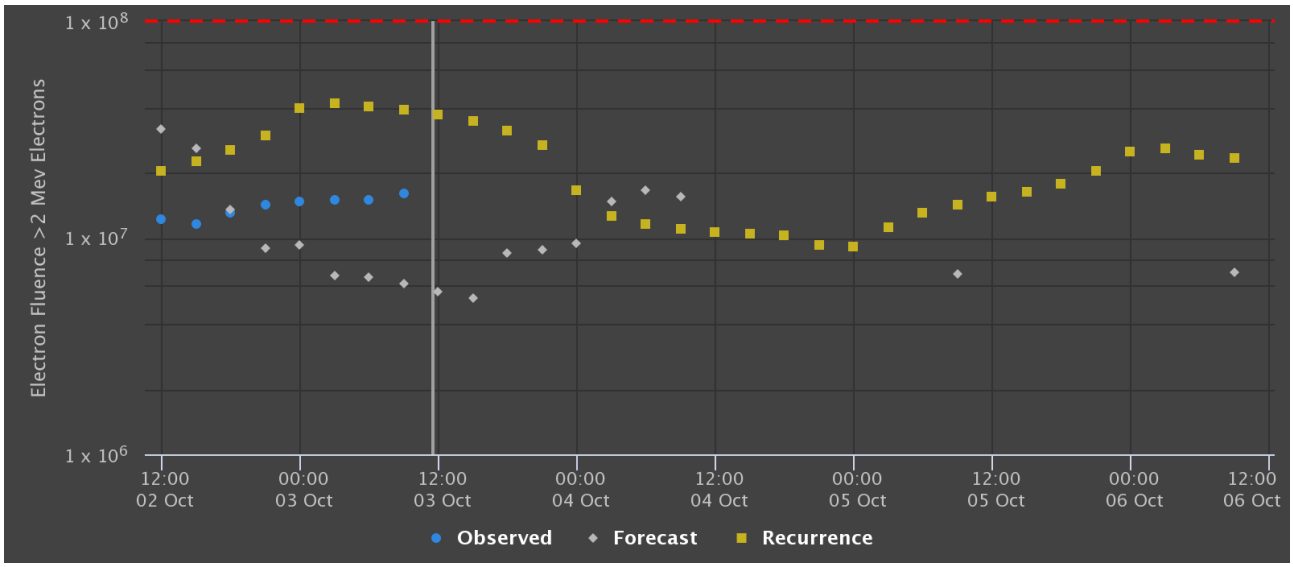
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) observed by GOES16, is at Background to Moderate levels, having now declined after previous enhancement. This is likely to drop out to become solidly background once any connection to to CH55 fast wind occurs either later day 1 or day 2 (03-04 Oct). A recovery in flux is then possible day 3 or day 4 (04-05 Oct) to mainly Moderate with a chance of peaking at High during diurnal maximum.

The associated 24 fluence is expected to remain below the Active threshold, with a generally declining trend. This is in agreement with REFM although the model is currently overestimating the current fluence. As any coronal hole enhancement eases day 3 onward, there is a chance of fluence increasing again, but is currently expected to remain below Active.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	5	10
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: MOSWOC REFM



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